CLAIMS

1. A method of generating a family of number sequences, comprising the steps of:

specifying a prime number, p, having magnitude greater than 3 and an associated Galois field, GF(p);

selecting a first primitive element of GF(p), α, and a second primitive element of GF(p), β, wherein $\alpha = \beta$ or $\alpha \neq \beta$;

defining a family of p+1 polynomials, wherein k is an integer and $0 \leq k \leq p$, wherein $f_k(x) = \mathrm{mod}_p(x^2+x+k)$ when $k<p$ and $f_k(x) = \mathrm{mod}_p(x+1)$ when $k = p$;

defining a family of p+1 matrices, wherein each matrix, $A^{(k)}$, has dimension (p-1) × (p-1) and the element of row i in column j of matrix $A^{(k)}$, $A^{(k)}_{ij}$, is defined to have a first state when $f_k(\alpha^i)=\mathrm{mod}_p(\beta^j)$ and is otherwise defined to have a second state; and

producing a family of p+1 number sequences, wherein the values of members of each number sequence, S_k, are determined in accordance with the elements of a corresponding matrix, $A^{(k)}$, of said family of p+1 matrices.

2. The method of claim 1, wherein producing a family of p+1 number sequences comprises the steps of:

enumerating the position of each element $A^{(k)}_{ij}$ within each matrix $A^{(k)}$, and

producing a number sequence, S_k, in accordance with each matrix, $A^{(k)}$, wherein the values of the members of said number sequence are the position numbers of the elements in said matrix having said first state.

3. The method of claim 1, wherein producing a family of p+1 number sequences comprises the step of:

producing in accordance with each matrix, $A^{(k)}$, a number sequence, S_k, having members in accordance with each column j of said matrix, wherein the value of a member is either the row index, i, of the element $A^{(k)}_{ij}$ within said column j having said first state or null when all elements within said column j have said second state.

4. The method of claim 1, wherein a number sequence, S_k, of said family of p+1 number sequences is mapped to a value layout having (p-1) components each having (p-1) subcomponents, wherein said number sequence has a maximum autocorrelation value that is less than or equal to 4 for any nonzero offset and a maximum cross-correlation value that is less than or equal to 4 for any offset when correlated against a second number sequence of said family of p+1 number sequences.

5. The method of claim 4, wherein said value layout corresponds to layout for at least one characteristic of a non-impulse radio signal.

6. The method of claim 5, wherein said characteristic is one of:

a frequency characteristic;

a phase characteristic;

a phase difference characteristic;

a time characteristic;

a spreading code characteristic; and

an amplitude characteristic.

7. The method of claim 5, wherein said non-impulse radio signal is one of:

   a CDMA signal;

   a TD-CDMA signal;

   a TDMA signal;

   a FDMA signal;

   an OFDM signal;

   a frequency-hopping system signal; and

   a direct sequence system signal.

8. The method of claim 4, wherein said value layout corresponds to a layout for at least one characteristic of an impulse radio signal.

9. The method of claim 8, wherein said characteristic is one of:

   a temporal pulse characteristic; and

   a non-temporal pulse characteristic.

10. The method of claim 9, wherein said temporal pulse characteristic is a position in time.

11. The method of claim 9, wherein said non-temporal pulse characteristic is one of:

a pulse amplitude;

a pulse width;

a pulse polarity; and

a pulse type.

12. The method according to claim 11, wherein said pulse polarity indicates whether said pulse is inverted.

13. A method of generating a family of codes that satisfy defined correlation properties, comprising the steps of:

defining a signal characteristic value layout having n components;

subdividing each of said n components into m subcomponents;

generating said family of codes, wherein at least one code of said family of codes specifies that a signal is not present in at least one of said components but no more than two of said components when mapped to said signal characteristic value layout.

14. The method of claim 13, wherein $m = n$.

15. The method of claim 13, wherein the maximum cross-correlation of any two codes of said family of codes is less than or equal to 4 and the maximum autocorrelation of any code in said family of codes is less than or equal to 4 for any nonzero offset.

16. The method of claim 13, wherein said signal characteristic is one of:

a frequency characteristic;

a phase characteristic;

a phase difference characteristic;

a time characteristic;

a spreading code characteristic; and

an amplitude characteristic.

17. A method of code compression, comprising the steps of:

enumerating the position of each element of a matrix corresponding to a code having defined correlation properties, wherein said code specifies a signal is not present in one or more components of a signal characteristic value layout; and

storing in an array the assigned position number of each said element having a value that corresponds to a subcomponent within a component of said signal characteristic value layout.

18. The method of claim 17, wherein said matrix has n rows and m columns.

19. The method of claim 18, wherein the position number of each element, $n_{ij} = j \times n + i$, wherein $0 \leq i \leq (n\text{-}1)$ and $0 \leq j \leq (m\text{-}1)$.

20. The method of claim 17, wherein said signal characteristic is one of:

a frequency characteristic;

a phase characteristic;

a phase difference characteristic;

a time characteristic;

a spreading code characteristic; and

an amplitude characteristic.